

QA/QC-Workshop, Spoleto, January 18-19, 2004

**DIFFERENCES IN BLOCK-AVERAGED FLUXES
OBTAINED AFTER PLANAR FIT, DOUBLE AND TRIPLE
ROTATION FOR THE SLOPING SITE BÍLÝ KŘÍŽ**

Pavel Sedlák and Kateřina Potužníková
Institute of Atmospheric Physics AS CR, Prague

Kateřina Havránková
Institute of Landscape Ecology AS CR, Brno

- paper submitted:

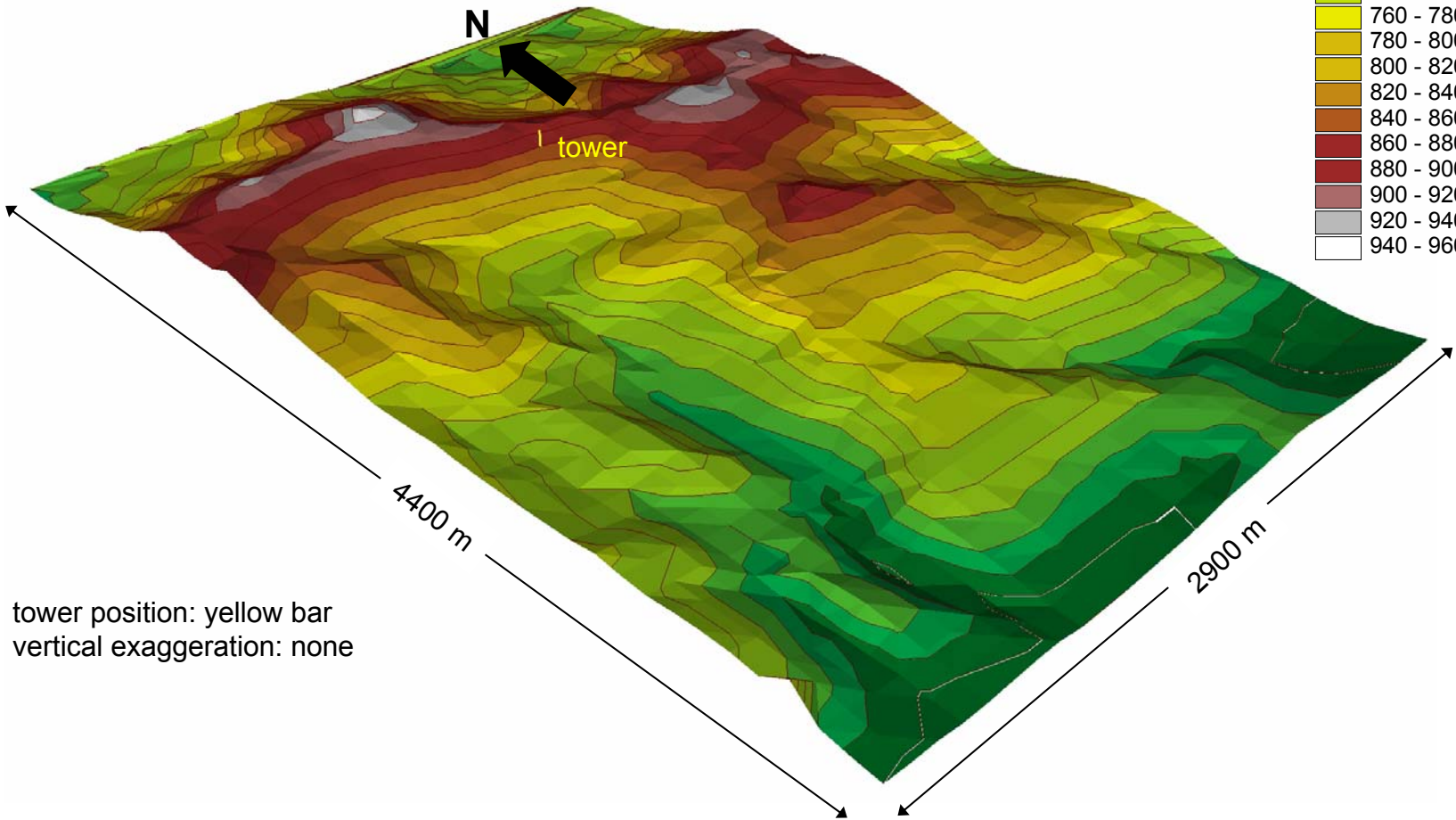
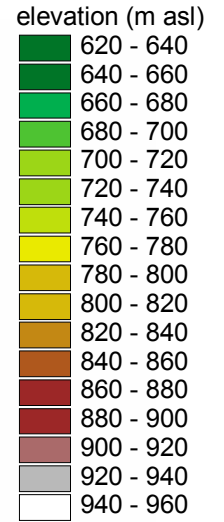
Sedlák P., Havránková K., Potužníková K.: Planar fit method applied to turbulent fluxes measured at sloping site Bílý Kříž. Submitted to special issue of *Theoretical and Applied Climatology*, October 2003.

- related to:

Finnigan J.J., Clement R., Malhi Y., Leuning R., Cleugh H.A., 2003: A re-evaluation of long-term flux measurement techniques. Part I: Averaging and coordinate rotation. *Boundary-Layer Meteor.* **107**, 1-48.

CZ1 Bily Kriz

topography



tower position: yellow bar
vertical exaggeration: none

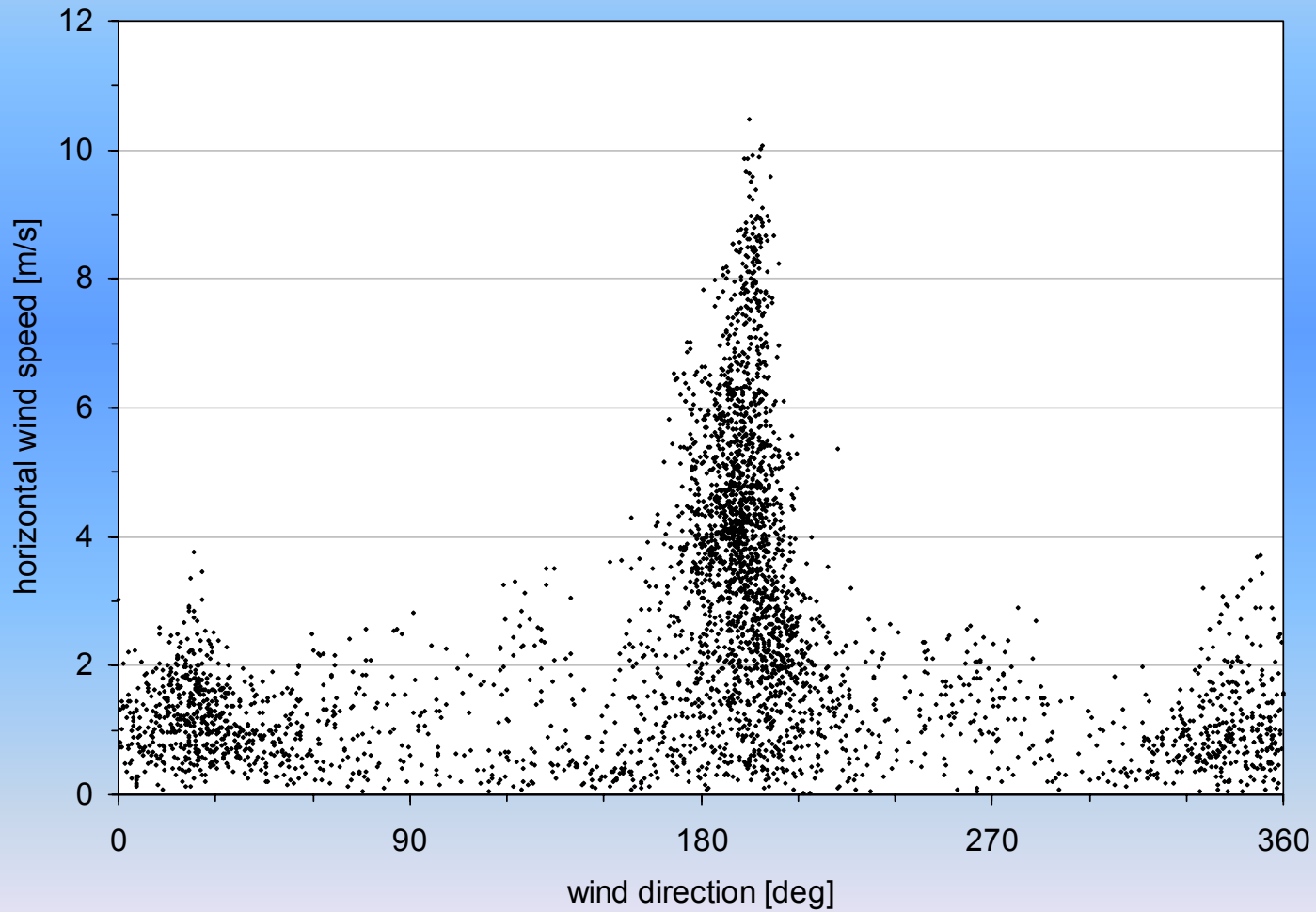
FOREST STAND AND MEASUREMENT SETUP 2000

- Homogeneous spruce forest
H = 8.5 m, $d = 6.3$ m, LAIp = 8.6
- Uniform slope 13°, SSW oriented
- Eddy covariance system, $z_m = 12$ m
- Vertically oriented anemometer
Gill Solent R2
- Closed-path IRGA
LI-6262

RAW DATA REPROCESSING METHOD

- EdiRe software package
- Block time averaging of 30 min series
- No detrending, no spectral correction
- a) Planar fit (PF), b) double (2R), c) triple (3R) rotation during reprocessing
- Stationarity tests – soft (75%) criterion (Rebmann et al., 2004 – Carboeuroflux WP7)
- Comparison of turbulent fluxes
- Cospectra comparison

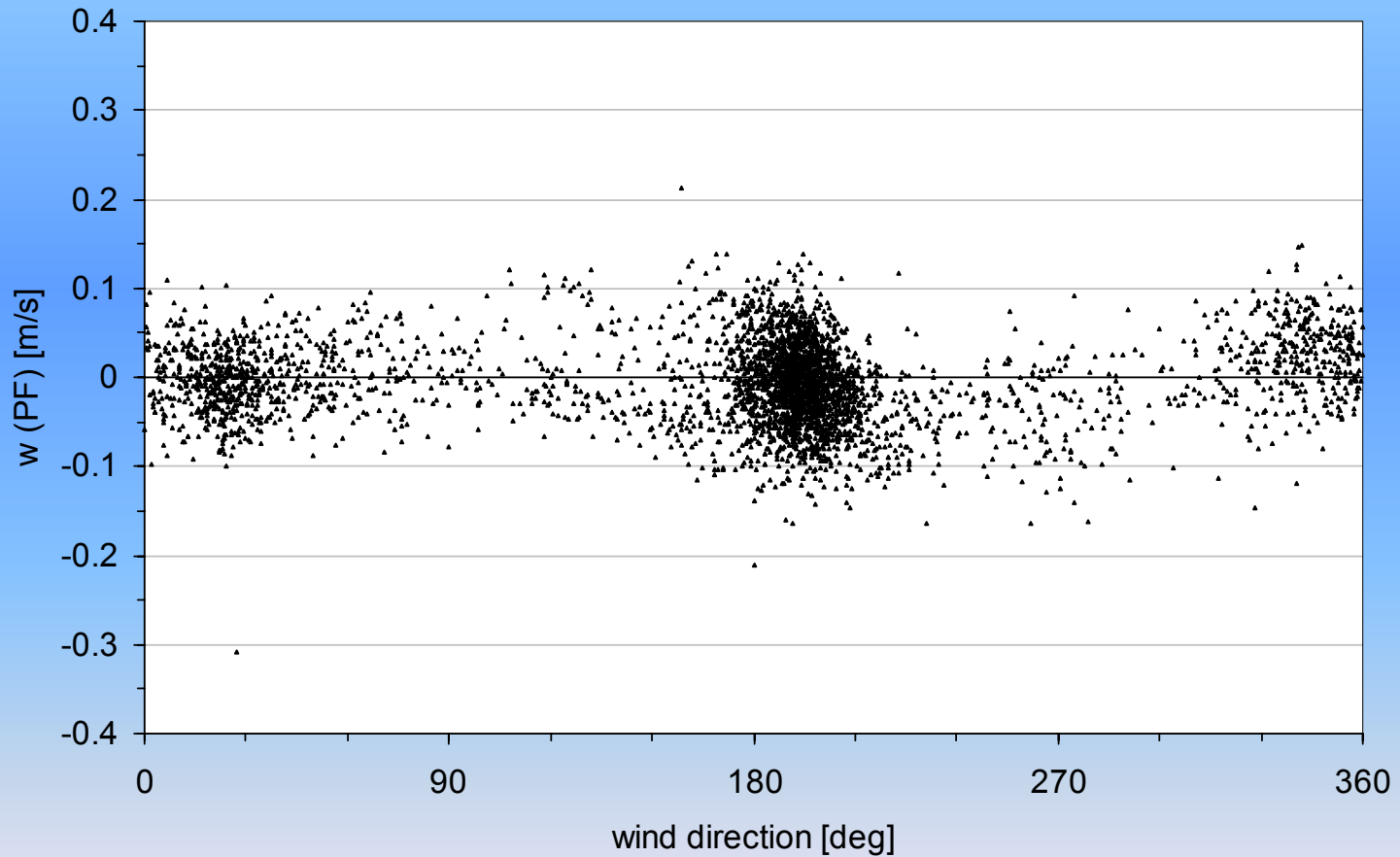
WIND SPEED VS. WIND DIRECTION



PLANAR FIT RESULTS

- $\hat{w} = b_0 + b_1 \cdot u_h + b_2 \cdot v_h$
- $\hat{w} = b_0 - U_h (b_1 \cdot \sin \varphi + b_2 \cdot \cos \varphi)$
- Bílý Kříž results 2000:
 $\hat{w} = -0.0179 + 0.06827 u_h + 0.2587 v_h$
 $R^2 = 0.994$

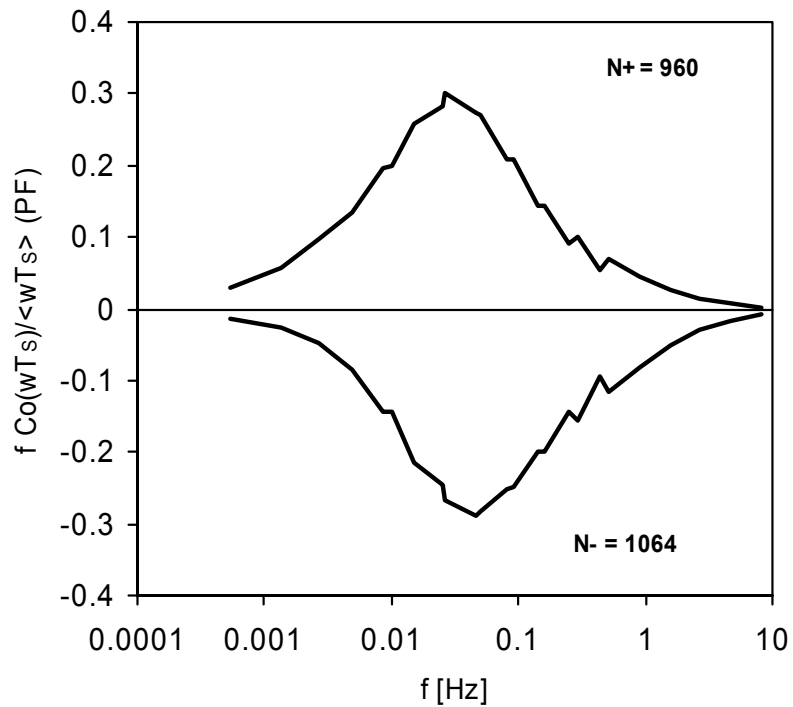
***w*-COMPONENT OF VELOCITY IN PLANAR FIT COORDINATES (=> NON-ZERO VERTICAL ADVECTION)**



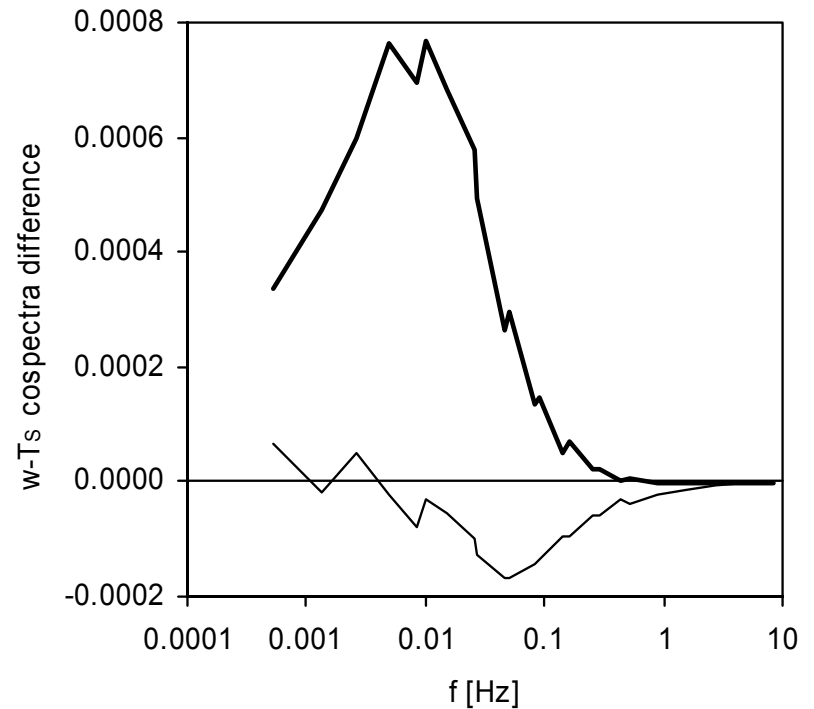
LINEAR REGRESSION OF ROTATED FLUXES

Regression	Flux	a	b	R^2
2R vs. PF	buoyancy	1.0411	0.9852	0.9914
	CO ₂	1.0586	-0.0603	0.9691
	latent heat	1.0653	0.6090	0.9535
3R vs. PF	buoyancy	0.9970	0.4601	0.9938
	CO ₂	0.9669	-0.1440	0.9536
	latent heat	0.9758	0.2755	0.9597

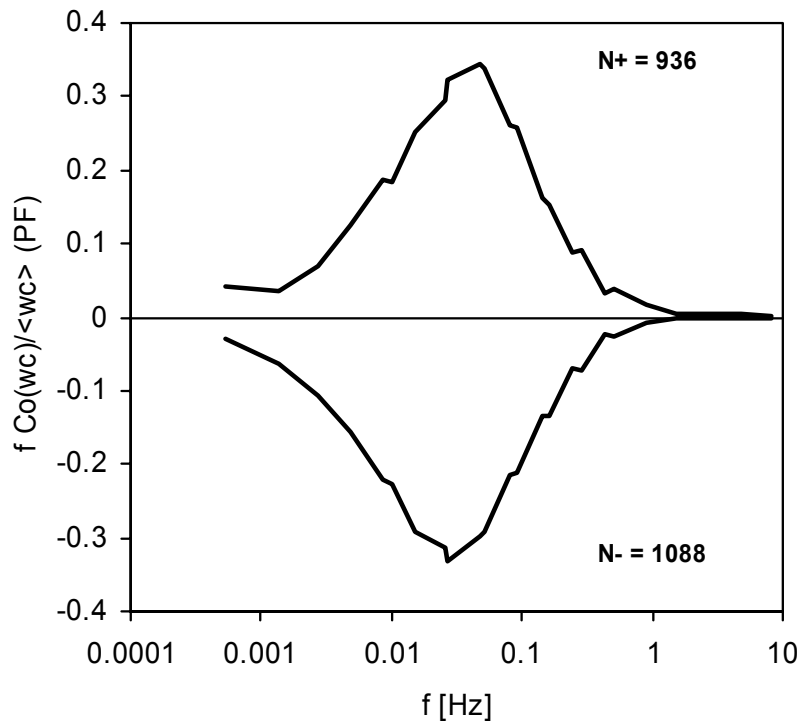
$w-T_s$ COSPECTRA (PF) POSITIVE/NEGATIVE



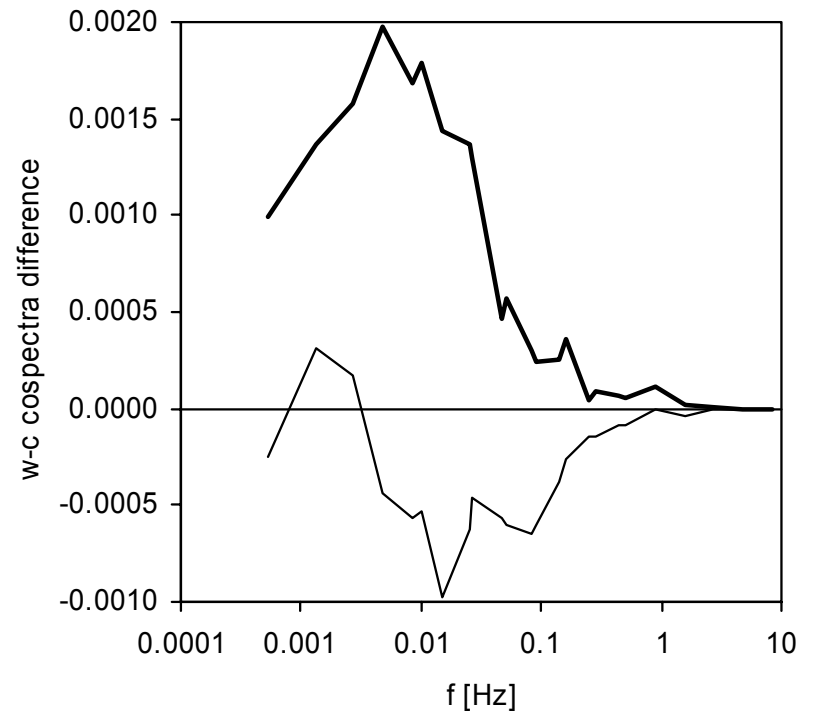
DIFFERENCES 2R-PF AND 3R-PF



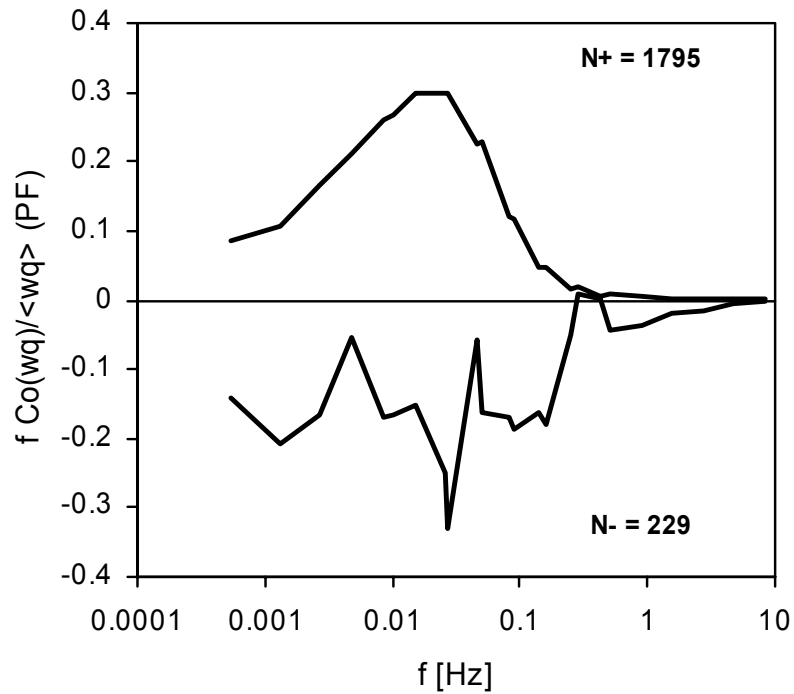
W-C COSPECTRA (PF) POSITIVE/NEGATIVE



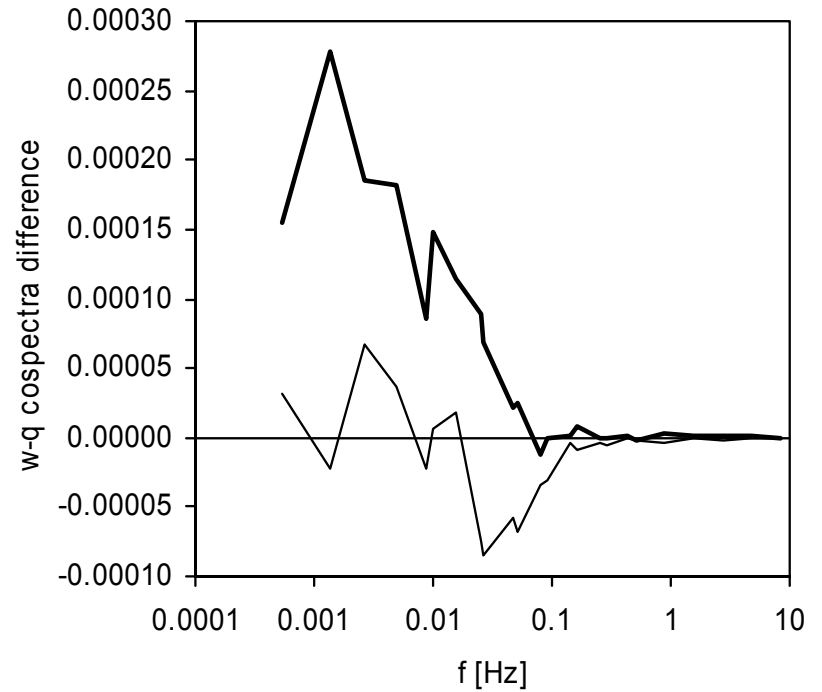
DIFFERENCES 2R-PF AND 3R-PF



w-q COSPECTRA (PF) POSITIVE/NEGATIVE



DIFFERENCES 2R-PF AND 3R-PF



CONCLUSIONS FOR BÍLÝ KŘÍŽ

- No high-pass filtering effect of double rotation on turbulent fluxes
- Double rotated fluxes 4-6.5% larger than planar fit rotated fluxes (greater low frequency contribution)
- Possible folding of mean streamline flux components into double rotated flux (Finnigan et al., 2003)
- Low-frequency flux contribution should be studied by extending the averaging period
- Potential effect of vertical (horizontal) advection on the mass balance